FORM PTO-1390 (REV 12-2001) U S DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE

TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371

ATTORNEY'S DOCKET NUMBER: DN1999223USA

U S APPLICATION NO. (If known, see 37 CFR 1 5): 10/089981

INTERNATIONAL APPLICATION NO.	INTERNATIONAL FILING DATE	PRIORITY DATE CLAIMED
PCT/US99/23312	October 6, 1999	

TITLE OF INVENTION
TIRE WITH KNURLS IN BEAD SURFACE

APPLICANT(S) FOR DO/EO/US
Hendrik Kornelis et al

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. [X] This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. [ ] This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. [ ] This is an express request to begin national examination procedures (35 U.S.C. 371(f)). The submission must include items (5), (6), (9) and (21) indicated below.
4. [X] The US has been elected by the expiration of 19 months from the priority date (Article 31).
5. [X] A copy of the International Application as filed (35 U.S.C. 371(c)(2))
   a. [ ] is attached hereto (required only if not communicated by the International Bureau).
   b. [ ] has been communicated by the International Bureau.
   c. [X] is not required, as the application was filed in the United States Receiving Office (RO/US).
6. [ ] An English language translation of the International Application as filed (35 U.S.C. 371(c)(2)).
   a. [ ] is attached hereto.
   b. [ ] has been previously submitted under 35 U.S.C. 154(d)(4).
7. [X] Amendments to the claims of the International Aplication under PCT Article 19 (35 U.S.C. 371(c)(3))
   a. [ ] are attached hereto (required only if not communicated by the International Bureau).
   b. [ ] have been communicated by the International Bureau.
   c. [ ] have not been made; however, the time limit for making such amendments has NOT expired.
   d. [X] have not been made and will not be made.
8. [ ] An English language translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371 (c)(3)).
9. [X] An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).
10. [ ] An English lanugage translation of the annexes of the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

Items 11 to 20 below concern document(s) or information included:

11. [X] An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
12. [ ] An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
13. [ ] A FIRST preliminary amendment.
14. [ ] A SECOND or SUBSEQUENT preliminary amendment.
15. [ ] A substitute specification.
16. [ ] A change of power of attorney and/or address letter.
17. [ ] A computer-readable form of the sequence listing in accordance with PCT Rule 13ter.2 and 35 U.S.C. 1.821 - 1.825.
18. [ ] A second copy of the published international application under 35 U.S.C. 154(d)(4).
19. [ ] A second copy of the English language translation of the international application under 35 U.S.C. 154(d)(4).
20. [X] Other items or information:

International Search Report
International Preliminary Examination Report

U.S. APPLICATION NO (if known, see 37 CFR 1.5)	INTERNATIONAL APPLICATION NO	ATTORNEY'S DOCKET NUMBER
10/089981	PCT/US99/23312	DN1999223USA

21. [X] The following fees are submitted:	CALCULATIONS PTO USE ONLY	
BASIC NATIONAL FEE (37 CFR 1.492 (a) (1) - (5)):		
Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO and International Search Report not prepared by the EPO or JPO **$1040.00**		
International preliminary examination fee (37 CFR 1.482) not paid to USPTO but International Search Report prepared by the EPO or JPO **$890.00**		
International preliminary examination fee (37 CFR 1.482) not paid to USPTO but international search fee (37 CFR 1.445(a)(2)) paid to USPTO **$740.00**		
International preliminary examination fee (37 CFR 1.482) paid to USPTO but all claims did not satisfy provisions of PCT Article 33(1)-(4) **$710.00**		
International preliminary examination fee (37 CFR 1.482) paid to USPTO and all claims satisfied provisions of PCT Article 33(1)-(4) **$100.00**		
ENTER APPROPRIATE BASIC FEE AMOUNT =	$ 890.00	
Surcharge of **$130.00** for furnishing the oath or declaration later than [ ] 20 [ ] 30 months from the earliest claimed priority date (37 CFR 1.492(e)).	$	

CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE		
Total claims	3 - 20 =	0	x **$18.00**	$	
Independent claims	1 - 3 =	0	x **$84.00**	$	
MULTIPLE DEPENDENT CLAIM(S) (if applicable)			+ **$280.00**	$	
TOTAL OF ABOVE CALCULATIONS =				$	
[ ] Applicant claims small entity status. See 37 CFR 1.27. The fees indicated above are reduced by 1/2.			+	$	
SUBTOTAL =				$	
Processing fee of **$130.00** for furnishing the English translation later than [ ] 20 [ ] 30 months from the earliest claimed priority date (37 CFR 1.492(f)).				$	
TOTAL NATIONAL FEE =				$	
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). **$40.00** per property +				$	
TOTAL FEES ENCLOSED =				$ 890.00	
				Amount to be refunded:	$
				charged:	$

a. [ ] A check in the amount of $ _____ to cover the above fees is enclosed.

b. [X] Please charge my Deposit Account No. 07-1725 in the amount of $ 890.00 to cover the above fees. A duplicate copy of this sheet is enclosed.

c. [X] The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 07-1725 . A duplicate copy of this sheet is enclosed.

d. [ ] Fees are to be charged to a credit card. **WARNING:** Information on this form may become public. **Credit card information should not be included on this form.** Provide credit card information and authorization on PTO-2038.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137 (a) or (b)) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO

David L King
SIGNATURE

David L King
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33,925
REGISTRATION NUMBER

cc: J E Grillo

TIRE WITH KNURLS IN BEAD SURFACE

Technical Field

This invention relates to pneumatic tires and, more particularly, to their tendency to slip with respect to the rims on which they are mounted when torque beyond a certain limit is applied.

Background Art

A pneumatic tire is secured to a rim by the interaction between the bead of the tire and the rim. The quantity of force holding the tire to the rim F_B is equal to the flange force and the bead force. The flange force is calculated by multiplying the surface area of contact between the bead and the rim A_f with the average pressure on the flange P_f. The pressure on the flange outside the footprint is roughly the same as the air pressure within the tire. In the footprint area, the flange pressure dramatically increases. The bead force is calculated by multiplying the pressure exerted by the bead hoop P_B and the surface area of the bead in contact with the rim A_B. Thus, $F_B = (P_f \times A_f) + (P_B \times A_B)$.

Tire slippage can occur when a high torque load is applied to a tire. Such high torque loads are common in many applications, such as a tractor pulling a plow. A tire will slip on a rim when the torque moment M_T is greater than the moment M_R holding the tire on the rim, shown in Fig. 1. The torque moment M_T is calculated by multiplying the force applied to the tire F_T and the radius from the axis of rotation to the radially outermost surface of the tire R_T. The moment M_R holding the tire on the rim is calculated by multiplying the force holding the tire on the rim F_B and the radius from the axis of rotation to the rim and bead connection R_R, and the static coefficient of friction between the bead surface and the rim surface, μ_s. When $F_T \times R_T$ is greater than $F_B \times R_R \times \mu_s$, the tire will slip on the rim. When $F_T \times R_T$ is less than or equal to $F_B \times R_R \times \mu_s$ the tire will not slip on the rim.

$$F_T > (F_B \times R_R \times \mu_s)/R_T, \text{ slippage.}$$

$$F_T \leq (F_B \times R_R \times \mu_s)/R_T, \text{ no slippage.}$$

Slippage of the tire on the rim has become an increasing problem with the continuing trend of manufacturers building larger and higher horsepower tractors. As the size and horsepower of tractors increase, the torque loads that the tires may be subjected to increases. As a result, the likelihood of tire slippage increases.

Another reason for tire slippage in large tires, such as farm tires, is that many of these tires are lubricated with a water-based lubricant to aid in the mounting process. After the tire is mounted on the rim, the water base in the lubricant dries, leaving a residue between the rim and the tire. As the tire enters a wet environment, water that migrates to the area between the rim and the tire reactivates the lubricant. As the lubricant becomes reactivated by the water, the coefficient

of static friction μ_s is lowered and slippage is much more likely to occur.

One solution to the problem of tire slippage is to glue the tire to the rim. The glue increases the moment M_R holding the tire on the rim because an adhesion force F_A is added. Thus, when the tire is glued to the rim:

$$F_T > ((F_B \times R_R \times \mu_s) + (F_A \times R_R))/R_T, \text{ slippage.}$$

$$F_T \leq ((F_B \times R_R \times \mu_s) + (F_A \times R_R))/R_T, \text{ no slippage.}$$

Although this solution helps to prevent slippage of the tire on the rim, gluing the tire to the rim is a cumbersome process and creates difficulties in dismounting the tire and placing a new tire on the same rim.

In an attempt to prevent tire slippage in motorcycle tires under stressful conditions, United States Patent No. 4,561,481 entitled "TIRE RIM STRUCTURE AND METHOD OF MANUFACTURE" teaches the use of rows of protrusions extending outwardly and integrally with the surface of the rim. These rim protrusions, or rim knurls, are intended to grip, or bite into, the motorcycle tire to prevent slippage. This technique of adding rim knurls has been adopted as a standard in certain tractor design rims, i.e. European Tyre and Rim Technical Organization (ETRTO), 1995 Standard Manual, page R32, shown in Fig. 2.

Rim knurls are common because the metal knurls bite into the softer rubber and grip the tire. Since the knurls grip the tire, the tire will not slip unless the force applied to the knurls is great enough to either shear each of them off of the rim or to tear the rubber being gripped by each of the knurls. A tire will be able to withstand a greater torque before slipping on the rim if this shear force F_S multiplied by the number of knurls, $\sum_N$, is greater than the loss of force holding the tire on the rim. The loss of force holding the tire on the rim results from two sources. First, the rubber of the bead surface may not deform sufficiently to completely fill the area between the rim knurls. The amount surface area contact between the rim and the bead surface may decrease as a result of this lack of deformation. If a decrease in surface area contact results, the force holding the tire on the rim F_{B2} will also decrease. Secondly, when the bead surface is contacted by rim knurls, the pressure of the bead surface against the rim will vary across the area between adjacent knurl peaks. The pressure will be the greatest at the peak of each knurl and will equal either the respective flange pressure P_f or the bead pressure P_B depending upon the location of the knurls on the rim. This pressure will decrease as to the distance from the knurl peak increases. This decrease in pressure is due to the surface tension of the rubber of the bead surface limiting the amount of deformation and preventing the rubber from completely filling the area between the knurls. As a result of this surface tension, the pressure will decrease from a maximum level at the knurl peak to zero at the point on the knurl sidewall where the rubber stops making contact with

the knurl.

United States Patent No. 4,015,652 shows a tire and rim assembly where both the vertical area of the tire and the rim flange have a plurality of protrusions. Each of the protrusions disclosed in this patent forms a complete line extending circumferentially around the tire and the rim. The protrusions increase the surface area between the two surfaces where an adhesive is applied to help retain a deflated tire on the rim. Although the increased area of contact caused by the disclosed protrusions may slightly increase the amount of torque the tire can withstand before slippage occurs, the disclosure shows no teaching concerning tire slippage. Additionally, the circumferential orientation of the protrusions will not provide any shear force resistance to tire slippage.

The most relevant prior art patent is U.S. 1,396,515 dated November 8, 1921, teaches a pneumatic tire suited for mounting on a rim having knurls designed to engage a bead surface of the tire where the tire has knurls, the knurls on the tire having a location and a pitch complimentary to the knurls on the rim such that the knurls interlock with the knurls on the rim 9 in order to prevent tire slip.

Summary of the Invention

This invention relates to a pneumatic tire 10. The pneumatic tire 10 has a bead 30 for mounting the tire 10 on a rim 12. The tire 10 is particularly suited for mounting on a design rim 12 having knurls 20. The rim knurls 20 are designed to engage the bead surface 28 of the tire 10. The bead surface 28 includes a bead base 36, a radially inner flange contacting surface 38, and a radially outer flange contacting surface 10.

The tire 10 of the invention has knurls 42. The tire knurls 42 have a location and a pitch that is complementary to the knurls 20 specified by applicable rim standards for the tire's size such that the tire knurls 42 interlock with the rim knurls 20 when the tire 10 is mounted on the design rim 12 at all three locations 36, 38 and 40. By interlocking the rim knurls 20 and the tire knurls 42, the tire 10 will be less susceptible to slippage. The knurls 42 are preferably of a triangular cross-section as well as the rim knurls 20.

Definitions

For ease of understanding this disclosure, the following terms are disclosed.

"Bead" means that part of the tire comprising an annular tensile member wrapped by ply cords and shaped, with or without other reinforcement elements such as flippers, chippers, apexes, toe guards and chafers, to fit the rim. The radially inner beads are associated with holding the tire to the rim.

"Bead surface" means the outer portion of the tire near the bead which is in proximity or

contacts the rim and consists of the bead toe, the bead base, the bead heel, and the flange contacting surface.

"Bead toe" means that portion of the bead which joins the bead base at the inside surface of the tire.

"Bead heel" means that portion of the bead which joins the bead base at the outer surface of the tire and is in proximity or in contact with the rim when the tire is mounted on the rim.

"Circumferential" means lines or directions extending along a perimeter of the surface of

the annular tire parallel to the Equatorial Plane (EP) and perpendicular to the axial direction.

"Design rim" or "rim" means a rim having a specified configuration and width. A design rim is specified by industry standards such as the Tire and Rim Association in the United States, the European Tyre and Rim Technical Organization - Standard Manual in Europe, and the Japan Automobile Tire Manufacturer's Association in Japan.

"Pitch" means the distance from one knurl peak to another.

"Pneumatic tire" means a laminated mechanical device of generally toroidal shape, usually open-torus, having beads and a tread and made of rubber, chemicals, fabric and steel or other materials. When mounted on the wheel of a motor vehicle, the tire through its tread provides traction and contains the fluid that sustains the vehicle load.

"Radial" or "radially" are used to mean directions radially toward or away from the axis of rotation.

Brief Description of Drawings

The invention will be described by way of example and with reference to the accompanying drawings in which:

FIG. 1 is a schematic displaying the forces acting upon a pneumatic tire to cause it to slip on a rim.

FIG. 2 is a drawing showing a design rim similar to that displayed in European Tyre and Rim Technical Organization (ETRTO), 1995 Standard Manual, page R32.

FIG. 3 is a partial view of the invention showing knurls in three locations upon the bead surface.

FIG. 4 is a cross section of the invention showing knurls in three locations upon the bead surface.

FIG. 5 is a cross section of the knurls. FIGS. 5A –5C show some of the various embodiments of the knurls of the invention.

FIG. 6 is a cross section showing the knurls of the invention interlocking with knurls of a rim.

Detailed Description of the Invention

Fig. 3 shows a partial view of the bead portion of a pneumatic tire 10 having a plurality of knurls 42 in three locations of the bead surface 28. The bead surface 28 is the location of the pneumatic tire near the bead 30 that is in proximity to or in contact with the rim 12 when the tire 10 is mounted. The bead surface 28 consists of an area of the tire 10 extending from the bead toe 32 across the bead base 36 to the bead heel 34 and then turning radially outward from the bead heel 34 across the flange contacting surface. The flange

contacting surface includes the radially inner flange contacting surface 38 and the radially outer flange contacting surface 40. When the pneumatic tire 10 is mounted on a rim 12, the bead base 36 is in proximity to the bead seat 14 of the rim 12 and the radially outer flange contacting surface 40 is in proximity of the flange radius 18 of the rim flange 16.

The plurality of knurls 42 in the three locations of the bead surface 28 provides the greatest resistance to slippage when the tire 10 is mounted on a rim 12 with corresponding rim knurls 20. Examples of some design rims 12 having knurls 20 are disclosed in European Tyre and Rim Technical Organization (ETRTO), 1995 Standard Manual at page R32 and the Tire and Rim Association, Inc., 1999 Year Book at page 8-41. A first reason for the increased resistance to slippage is that the surface area of contact between the pneumatic tire 10 and the rim 12 is greatest when the rim knurls 20 and the tire knurls 42 interlock. Since the sidewalls 50 of the knurls 42 on the tire 10 contact the sidewalls 52 of the knurls 20 in the rim 12, the area of contact increases. When the knurls are interlocked in all three locations of the bead surface 28 and the corresponding rim 12, the surface area of contact is maximized. Additionally, with knurls 42 in all three locations, the number of knurls, $\sum_N$, is increased. When the knurls are interlocked, slippage cannot occur unless each knurl of either the rim 12 or the tire 10 is sheared. Thus, a shear force F_S must be overcome before slippage can occur. Where both the pneumatic tire 10 and the rim 12 have interlocking knurls, the force holding the tire to the rim F_{B3} equals $(P_f \times (A_f + A_k)) + (P_B \times (A_B + A_k))$, where A_k is the increased contact area caused by the knurls. Therefore, with the pneumatic tire 10 of the invention used in conjunction with a design rim 12 having knurls 20:

$$F_T > ((F_{B3} \times R_R \times \mu_s) + (F_S \times \sum_N \times R_R))/R_T, \text{ slippage.}$$

$$F_T \leq ((F_{B3} \times R_R \times \mu_s) + (F_S \times \sum_N \times R_R))/R_T, \text{ no slippage.}$$

Although placing knurls 42 in all three locations of the bead surface 28 provides the most resistance to slippage, in many applications, applying knurls 42 in only one or two of these locations is necessary. When knurls 42 are added to only one area of the bead surface 28, consideration must be given to the contact pressure between the bead surface 28 and the rim 12. For the strongest resistance to slippage using knurls 42 in only one location of the bead surface 28, the knurls should be located where the pressure between the bead surface 28 and the rim 12 is greatest. An increase in the surface area by the addition of the knurl surface A_k will result in the greatest increase in the force holding the tire to the rim F_{B3}.

Fig. 4 shows a cross section of the bead portion of a pneumatic tire 10 having knurls 42 in all three locations of the bead surface 28. Although there is no minimum length L_k for the knurls

42, longer knurls 42 will provide greater resistance to slippage by adding surface area contact and greater shear resistance. For best results, the length L_k of the knurls 42 on the bead base 36 should be at least forty percent the length of the bead base L_b. However, ideally the length of the knurls 42 will match the length of the rim knurls 20.

Fig. 5 shows a cross sectional view showing three possible configurations of the knurls 42 on the bead surface 28. Fig. 5A shows a peak 44 of each, respective knurl 42 protruding from the bead surface 28. The base 48 of each knurl 42 is located on the same plane as the bead surface 28. Fig. 5B shows a peak 44 of each knurl 42 located in the same plane as the bead surface 28 and the base 48 of each knurl 42 located in an indention 46 in the bead surface 28. Fig. 5C shows a peak 44 of each knurl 42 protruding from the bead surface 28 and the base 48 of the knurls 42 in an indention 46 in the bead surface 28. Additionally, combinations of the configurations shown in Figs. 5A – 5C and other configurations for knurls are possible.

Although, Fig. 5 shows the knurls 42 having a triangular cross section, the cross section of the knurls 42 may be any shape which provides the desired effects of increasing the surface area and the shear resistance. Ideally, the shape of the knurls 42 will complement the shape of the rim knurls 20.

All of the knurls 42 shown in Figs. 5A - 5C can be molded onto the bead surface 28. The knurls can be formed by either protrusions or recesses in the mold or a combination of both. For the best seal, the tire knurls 42 should be properly designed to fit the appropriate rim knurls 20. If the rim knurls 20 are configured similar to the knurls in Fig. 5A, then the tire knurls 42 should be similar to the knurls of Fig. 5B. Similarly, if the rim knurls 20 are configured similar to the knurls in Fig. 5B, then the tire knurls 42 should be similar to the knurls in Fig. 5A. If the tire knurls 20 are configured similar to the knurls of Fig. 5C, then the tire knurls 42 should also be configured similar to the knurls in Fig. 5C. Although, Figs. 5A –5C show all the knurls 42 having the same depth and pitch, the depth and pitch of the knurl can vary. The most efficient location, length, depth and pitch of the tire knurls 42 match those of the rim knurls 20.

The tire 10 of this invention may be mounted on a rim 12 that does not have knurls 20. However, if this is attempted difficulty may arise in obtaining a proper seal for maintaining air pressure within the tire 10. Since the rubber of the tire knurls 42 will not bite into the metal rim, no shear force resistance will be gained by using the tire 10 on a non-knurled rim. Additionally, surface area contact between the rim and the tire 10 will likely be decreased.

Fig. 6 is a cross section of the knurls 42 on the bead base 36 of a pneumatic tire 10 interlocked with the knurls 20 on the bead seat 14 of a rim 12. Additionally, Fig. 6 shows how each sidewall 50 of the tire knurls 42 interacts with each sidewall 52 of the rim knurls 20 to

provide shear resistance to slippage. When the tire knurls 42 are designed to complement the rim knurls 20, the surface area contact between the rim 12 and the bead surface 28 will be increased. The surface area contact is increased as compared to a non-knurled rim because the sidewalls 52 of each rim knurl 20 increases available surface area. This increased surface area is contacted by the tire knurls 42. The surface area contact is increased as compared to a knurled rim 12 because the tire knurls 42 assure contact over the complete area between the rim knurls 20. The pressure of the bead surface 28 against the rim 12 is also equalized when the tire knurls 42 are designed to complement the rim knurls 20. Since surface tension in the bead surface 28 does not pull the tire knurls 42 away from the rim knurl sidewalls 52, the pressure of the bead surface 28 against the rim 12 is constant over the entire knurled surface.

CLAIMS

What it claimed is:

1. An improved pneumatic tire (10) particularly suited for mounting on a design rim (12) having knurls (20) designed to engage a bead surface (28) of the tire (10), the bead surface (28) including a bead base (36) and a radially inner flange contacting surface (38) and a radially outer flange contacting surface (40), the tire (10) having:

having knurls (42), the knurls (42) on the tire (10) having a location and a pitch complimentary to the knurls (20) specified by applicable rim standards for the tire's size such that the knurls (42) on the tire (10), when mounted on the design rim (12), interlock with the knurls (20) on the design rim (12), the tire (10) characterized by:

the knurls (42) being of a complimentary cross-section to the knurls (20) and located in all three locations of the bead surface (28), the bead base (36), the radially inner flange contacting surface (38) and the radially outer flange contacting surface (40), the knurls (42) being capable of interlocking with the design rim (12) in all three locations (36,38,40).

2. The improved pneumatic tire 10 of claim 1 wherein the knurls (42) having a triangular cross-section.

3. The improved pneumatic tire of claim 1 wherein the knurls (42) on the bead base (36) have a length L_k of at least 40% L_b.

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
12 April 2001 (12.04.2001)

PCT

(10) International Publication Number
WO 01/25030 A1

(51) International Patent Classification[7]: B60C 15/024, B60B 21/10, B60C 15/02, B60B 21/02

(21) International Application Number: PCT/US99/23312

(22) International Filing Date: 6 October 1999 (06.10.1999)

(25) Filing Language: English

(26) Publication Language: English

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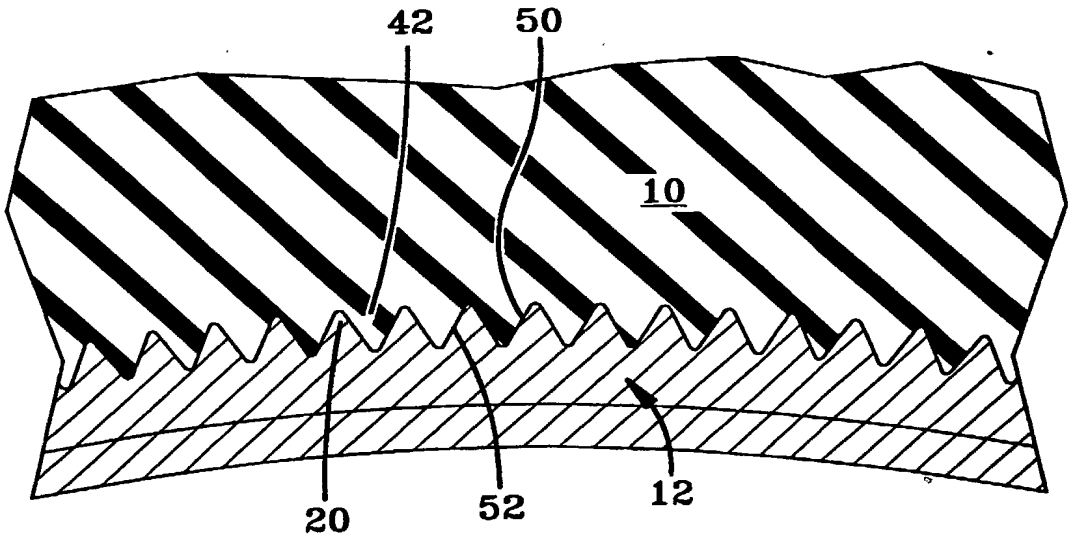
(81) Designated States *(national)*: AE, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZA, ZW.

(84) Designated States *(regional)*: ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

Published:
— *With international search report.*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: TIRE WITH KNURLS IN BEAD SURFACE



(57) Abstract: A pneumatic tire (10) particularly suited for mounting on a design rim (12) having knurls (20). The rim knurls (20) designed to engage a bead surface (28) of the tire (10). The tire knurls (42) having a location and a pitch complementary to the knurls (20) specified by applicable rim standards for a tire's size such that the knurls (42) on the tire (10) interlock with the knurls (20) on the design rim (12).

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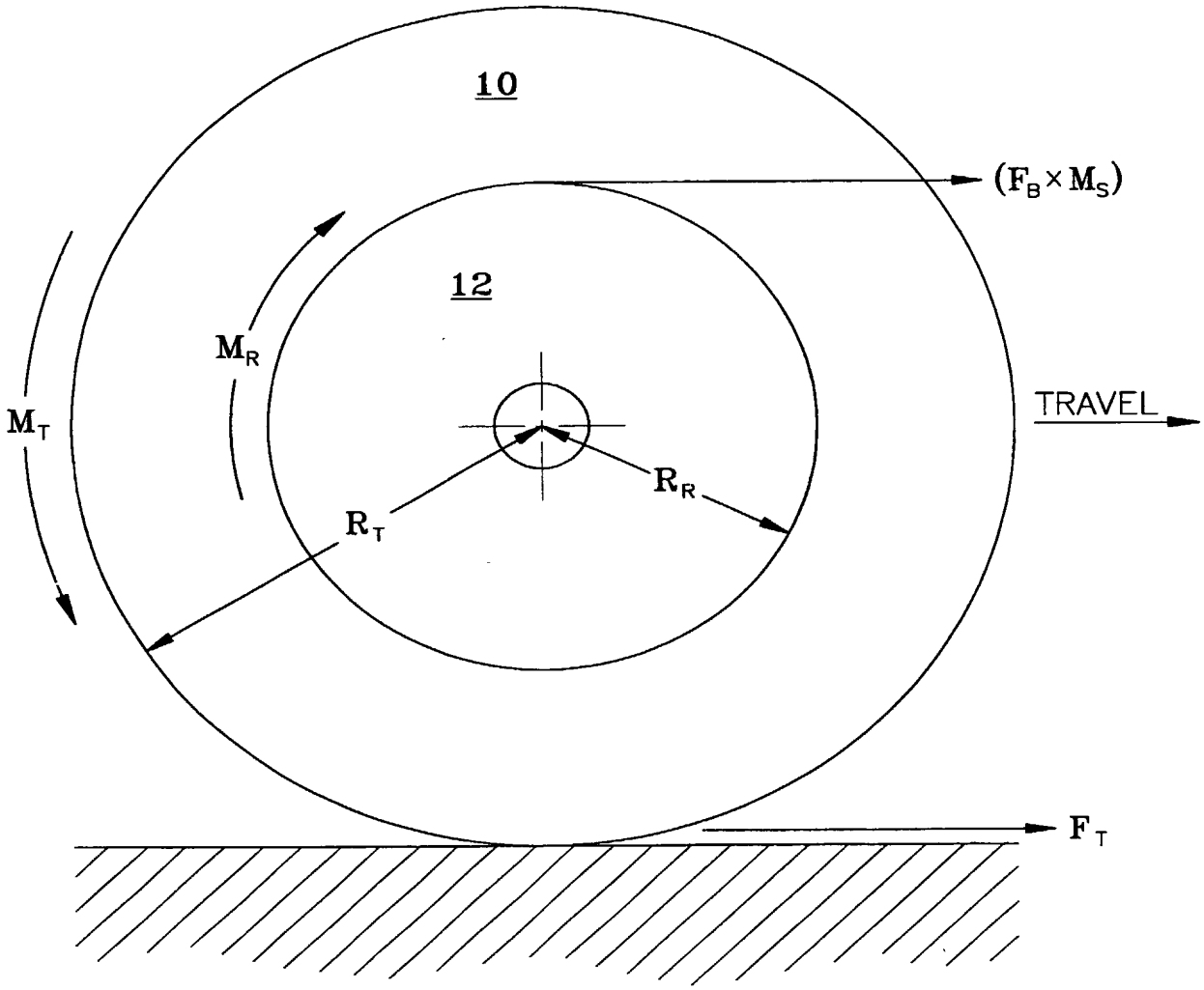
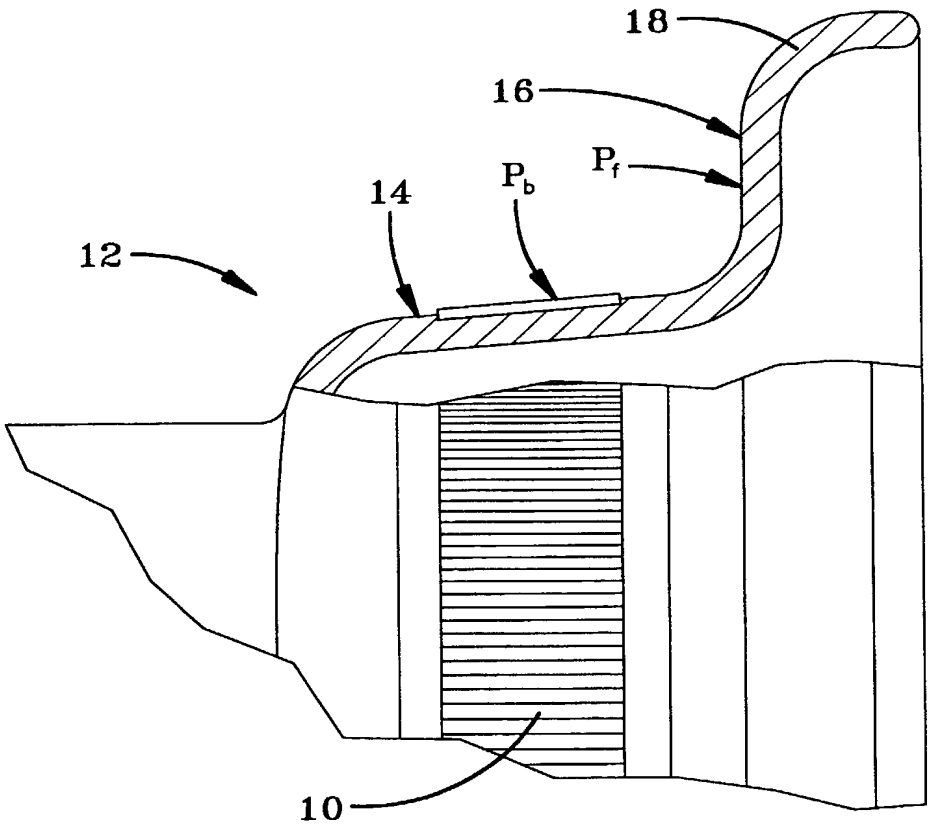


FIG−1



FIG–2
PRIOR ART

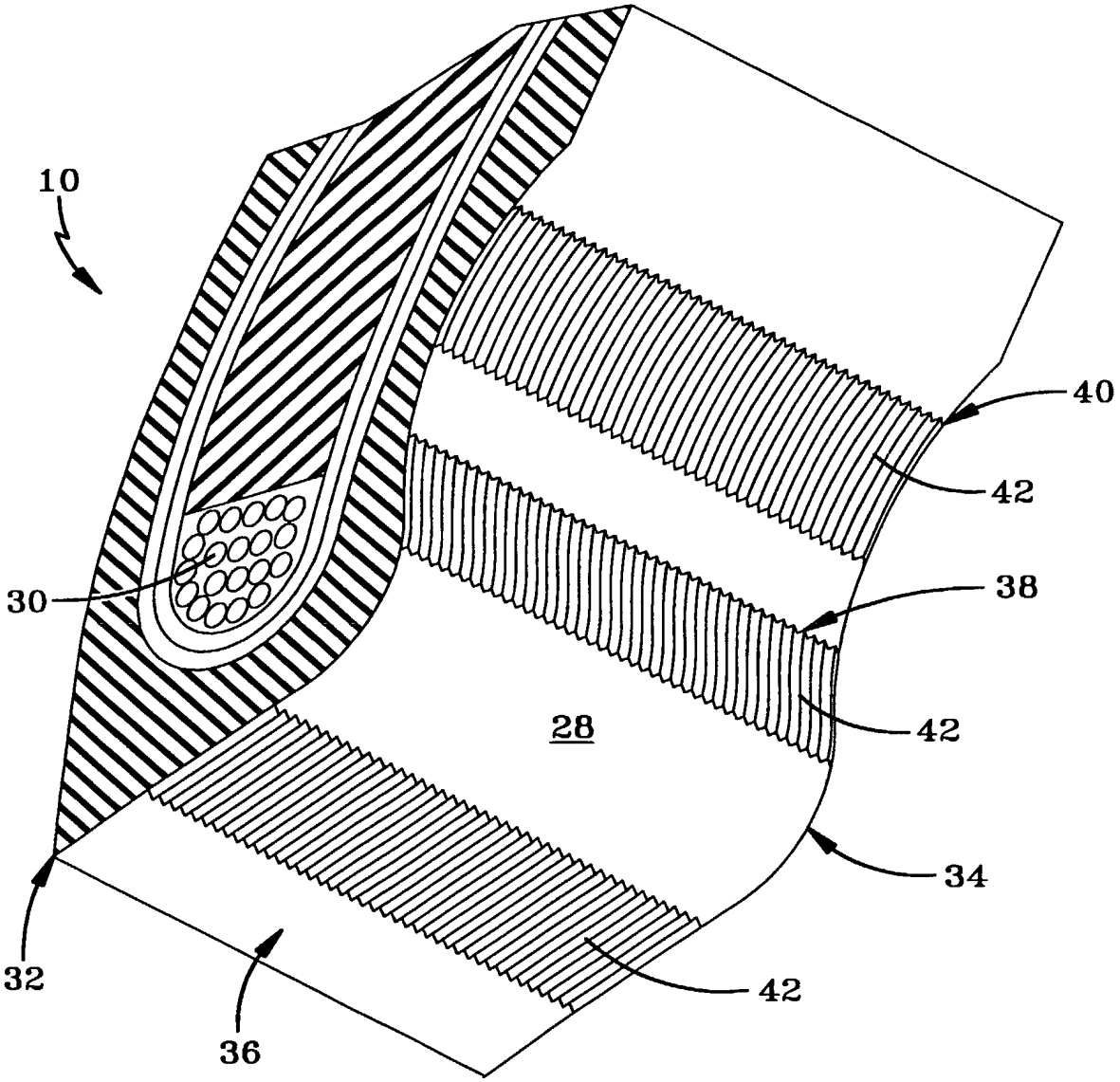


FIG-3

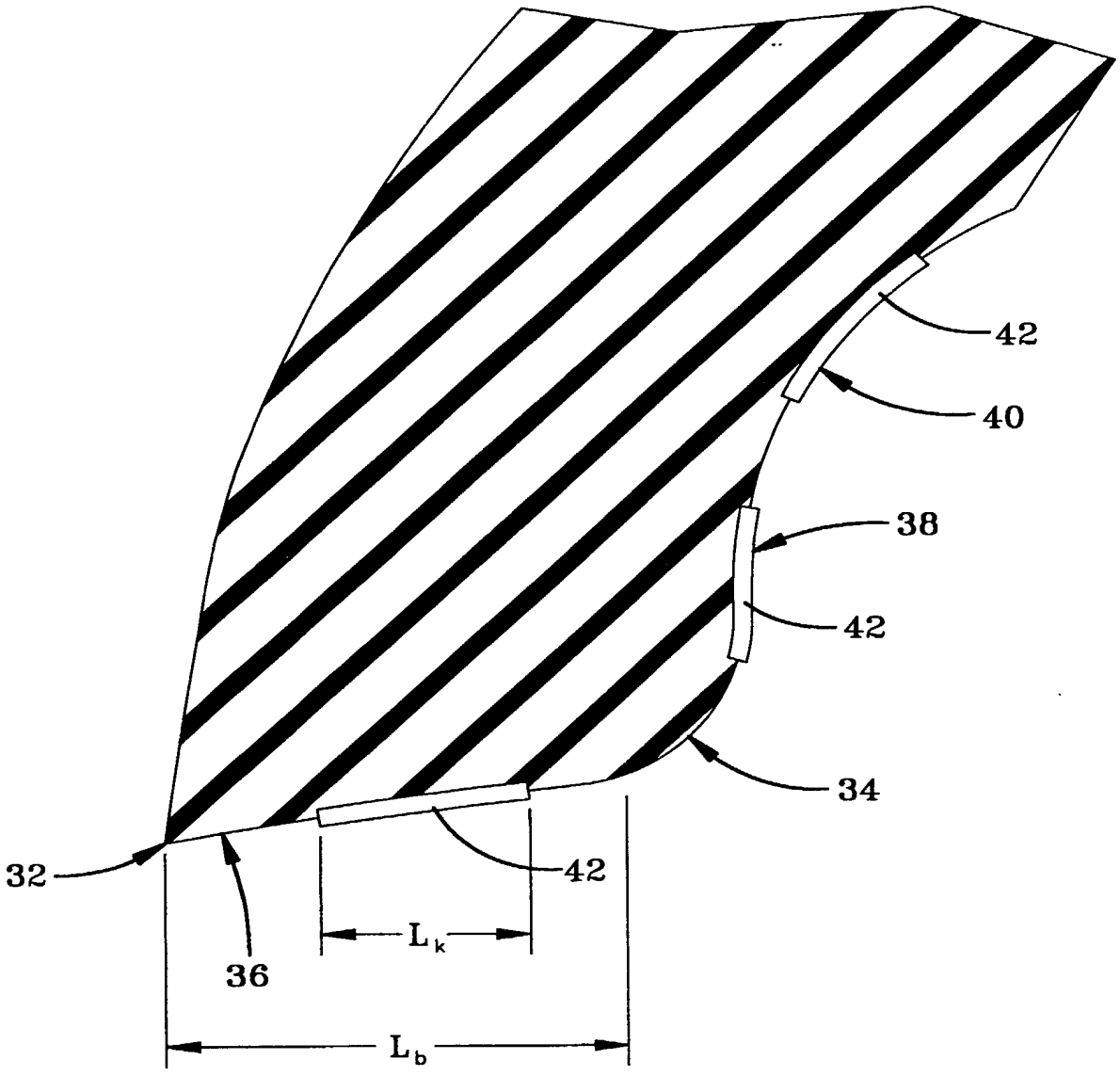


FIG-4

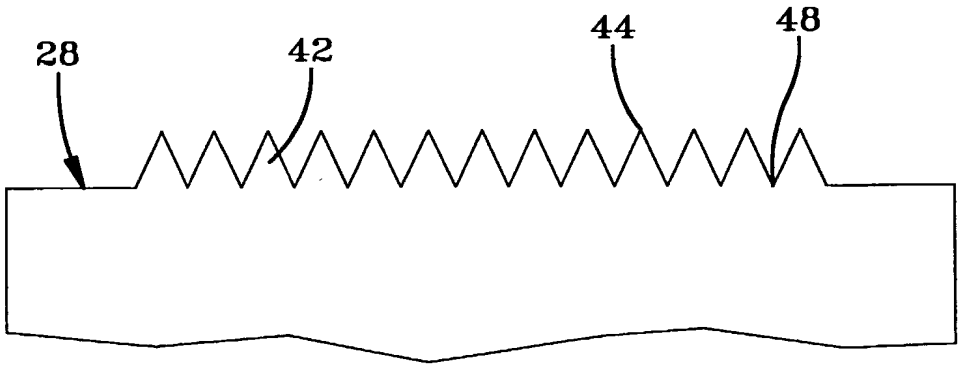


FIG-5A

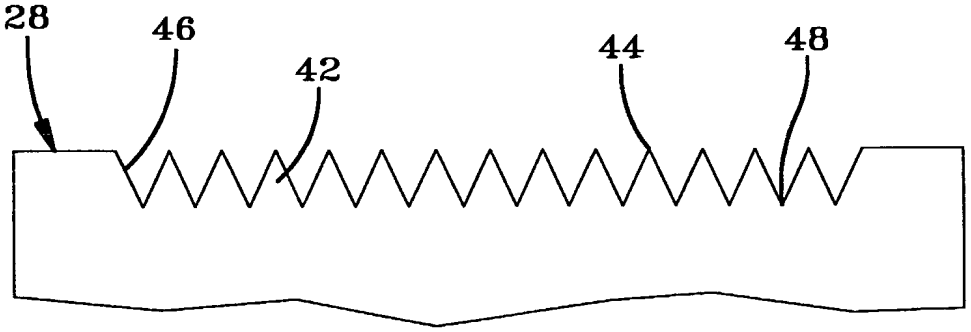


FIG-5B

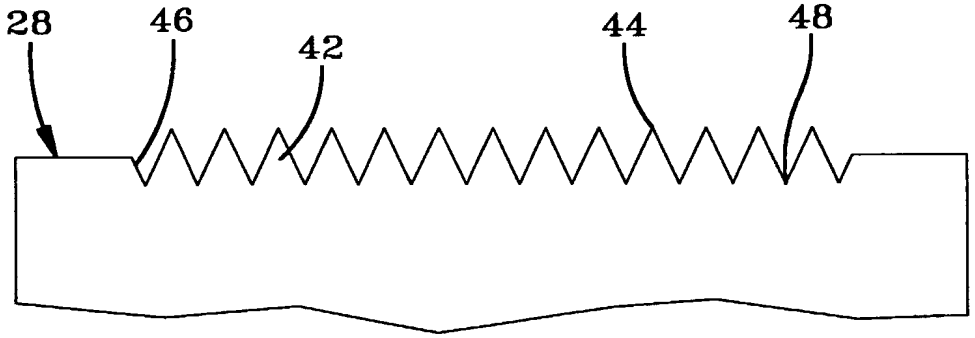
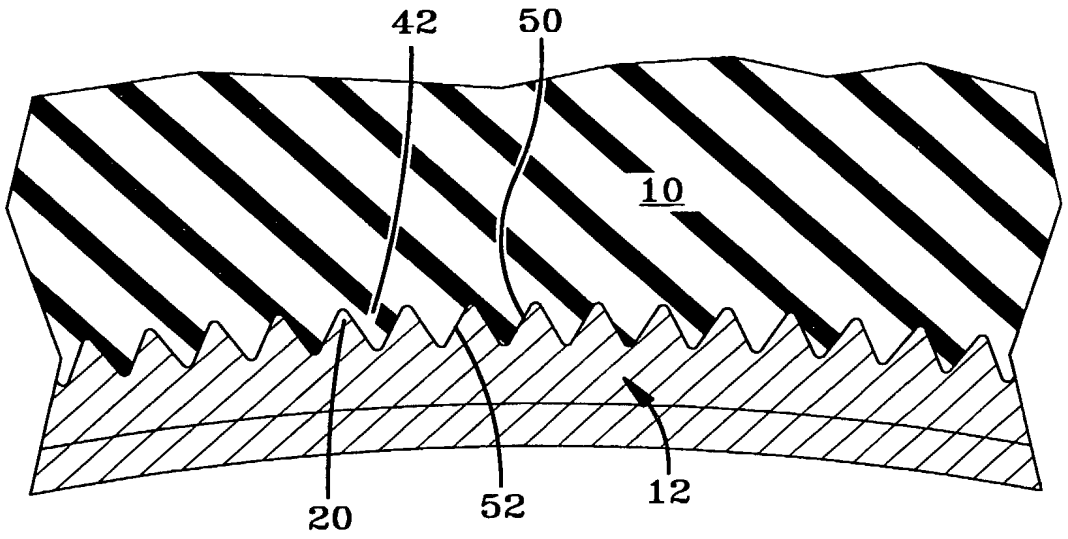


FIG-5C



FIG–6

Docket No. DN1999223USA

DECLARATION AND POWER OF ATTORNEY

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name.

I believe I am an original, first and joint inventor of the subject matter which is claimed and for which a patent is sought on the invention entitled **TIRE WITH KNURLS IN BEAD SURFACE** the specification of which _____ is attached hereto.

__X__ was filed on October 6, 1999, as Application Serial No. PCT/US99/23312 and was amended on _____ (if applicable).

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in 37 C.F.R. §1.56.

I hereby claim the benefit under 35 U.S.C. §119(e) of any United States provisional application(s) listed below:

_____ _____

(Application Serial No.) (Filing Date)

I hereby claim the benefit under 35 U.S.C. §120 of any United States application(s) or §365 of any PCT International application designating the United States, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application in the manner provided by the first paragraph of 35 U.S.C. §112, I acknowledge the duty to disclose information which is material to patentability as defined in 37 C.F.R. §1.56 which became available between the filing date of the prior application and the national or PCT international filing date of this application:

_____

(Application Serial No.) (Filing Date) (Status)(patented, pending, abandoned)

POWER OF ATTORNEY

As named inventor(s), I or we hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith.

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Nancy T Krawczyk	Registration No.	38,744
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Bruce J Hendricks	Registration No.	30,262
John D DeLong	Registration No.	44,648

(5)

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under section 1001 of Title 18 of the United States Code, and that such willful false statement may jeopardize the validity of the application or any patent issuing thereon.

1-CU

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Inventor's signature: H. Kornelis Date: 29/05/2002

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Inventor's signature: Pascal Guillaume Date: 05/31/2002

Residence: B-6600 Bastogne, Belgium BEL Citizen of: Belgium

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☐ Additional inventors are being named on separately numbered sheets attached hereto.

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